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Ecology of the weaver birds[1]

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(*With a map and a text-figure*)

The publication of SILENT SPRING (Carson 1962) did much to draw attention to the importance of birds to agriculture. In India Mason and Maxwell-Lefroy had investigated the economic status of birds in relation to agriculture by an analytical study of their food as early as 1912. Since then D'Abreu (1920), Mukherjee (1969, 1971) and a number of workers referred to by Mukherjee (op. cit.) have contributed to this subject. Ali & Ripley (1968-1973) presented all the data available on the food of individual species upto the time of publication of their serial volumes. Most of these publications were lists of the stomach contents of birds dissected by these authors.

In a general review of Economic Ornithology in India, Sálim Ali (1936) pointed out the need for thorough studies of more aspects of the biology of Indian birds including food, feeding behaviour, life history and population dynamics and emphasized the need for linking research in Economic Ornithology with agricultural research. I had the opportunity to study the ecology and biology of the Baya Weaver bird *Ploceus philippinus* Linnaeus from 1968 to 1971 under the guidance of Dr. Sálim Ali at the Bombay Natural History Society and with the cooperation of the agricultural universities of Andhra Pradesh and Tamil Nadu and the Zoology Department, Madras Christian College, Tambaram. This article[2] gives an outline of my work and a summary of the findings. This work had the financial support of the CSIR.

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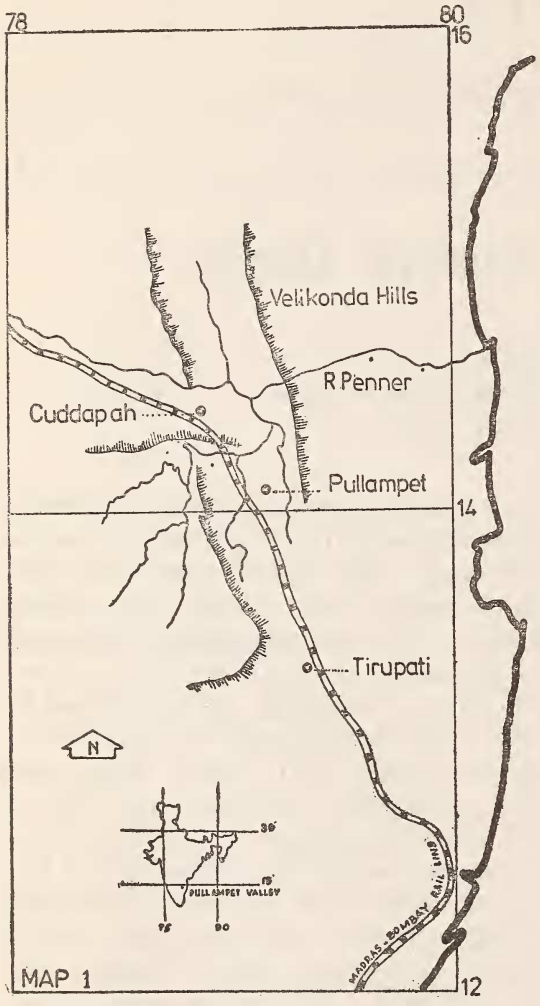
[2] Based on the thesis accepted by the Bombay University for the Ph.D. degree 1972.

The Area

The study area was the Pullampet Valley (*c.* 13°44'-14°15'N; 78°59'-79°29'E) in Rajampet Taluk, Cuddapah District of Andhra Pradesh. Pullampet as used here refers to my study area (Map 1) and not to the town of Pullampet which also lies in the same valley. The area is bounded on its three sides by hills of the Velikonda and the Palkonda ranges.



Map. Map showing study area of Pullampet Valley, Rajampet Taluk, Cuddapah district of Andhra Pradesh.

Pullampet is irrigated by two rainfed tanks through a number of canals, large wells, and a small seasonal hill stream. But for a greater part of the year the country looks burnt up and arid. Clustered around the irrigation wells are a few orchards of mango and patches under betel vine and sugar cane. The bare hills are dotted with a few patches of the aromatic grass *Cymbopogon coloratus* and thorny shrubs like *Zizyphus* sp., growing in sheltered nooks. It is hottest in Pullampet in May and coolest in January; driest in April and most humid in November. The rainy season is between June and December but rainfall is highly variable.

The uncultivated tracts in the study area are sparse scrub-jungles with plants like *Calotropis gigantea* R. Br., *Cassia auriculata* L., *Euphorbia tirucalli* L. and *Ixora parviflora* Vahl. The cultivated fields were bordered by shrubs like *Azima tetracantha* Lam., *Plectronia parviflora* Bedd., *Lantana aculeata* L., and *Ehretia mycrophylla* Lam. The Bayas nested around wells and canals fringed by trees like *Syzigium jambolanum* DC., *Ficus religiosa* L., *Phoenix sylvestris* Roxb., and *P. farinifera* Roxb.

Two crops of paddy were regularly raised from August-September to January-February and from December-January to April-May. Bajra (*Pennisetum typhoideum* Rich.) and ragi (*Eleusine coracana* Gaertn.) were regularly cultivated from July to September and from January to March. Ragi was grown at other times also. Jowar (*Sorghum* sp.) and Italian millet or korra (*Setaria italica* Beauv.) were cultivated once or twice between January and September. Sugar cane and betelvine were grown as rotation crops. The grasses *Echinochloa* (varieties *colona* Link and *crus-galli* Beauv.) accompanied crops of paddy. *Panicum repens* L. *Paspalum scrobiculatum* L., and *Digitaria marginata* Link. grew along the

bunds in paddy-fields and *Brachiaria ramosa* stapf in fallows.

Methods of study

In the study area the Baya is resident throughout the year and locally considered to be a pure pest. I studied the following aspects of the biology of this bird.

1. *Feeding habits and behaviour*

Bayas were observed in the field with the help of binoculars about seven times per month for one full year for durations of 1-4 hours at different times of the day and in different spots of the study area. Details of the patterns of feeding of individual birds, the size and structure of flocks, patterns of roosting and waking, and the seasonal changes in the feeding habits were noted.

2. *Food in stomachs and crops*

From 1968 March to 1969 February some 30-40 samples of adult Bayas were collected every month from communal roosts in the study area. By mist-netting only in the evenings it was possible to obtain birds with food in their crops for examination of the contents. The birds were dissected at the base camp and the contents of their crops and stomachs washed with water and dried in the open air. The different items of food were weighed and monthly summaries of their proportions by dry weight prepared. Seeds were identified at the Systematic Botany Section of the Tamil Nadu Agricultural University, Coimbatore. Plants collected in the study area aided the identification.

3. *Examination of living birds*

The living birds netted for ringing were examined through the transparent skins of their crops and their contents noted.

4. *Experiments on captive Bayas*

Several feeding experiments were done on captive Bayas freshly caught from the wild to test their capacity for consuming seeds of paddy and *Echinochloa* spp., and their preference for different types of grains. Adult Bayas of both sexes were tested in two sets of five each housed in plywood and wire mesh cages 37.5 × 37.5 × 114.5 cm in size for ten continuous days. Each morning a fresh weighed quantity of grains was placed in the cage and each evening the remainder removed cleaned dried and weighed. To see if the easy availability of water influences the uptake of grains a control set was given only limited quantities of water.

5. *The food of the nestling Baya*

In day-long observations at different nests in 1970, the frequency of visits by parents with food and the type of food brought to feed the nestlings were noted. Stomach contents of 53 nestling birds were analysed and the different items identified.

6. *Age and appearance of the Baya*

To correlate appearance of the birds with their age birds of different age-classes (from the nestling to adult) were ringed and released and many of the ringed birds retrapped and examined again. Details of the colours of bill and plumage, and the pattern of moult of feathers, were examined in 1545 living birds and 531 preserved specimens. The peculiarities of plumage of each bird were noted down.

7. *Breeding ecology*

In a tract of about 282 ha. in the study area, the life-history of the Baya from egg to first breeding was worked out. Loss of eggs and nestlings, annual turnover of young and their pattern of dispersal were studied. The numbers of adult birds, active nests, new nests under construction and breeding males of this tract counted once a week from June to October, 1970, served as indices to their population.

8. *Status and local movements of the Baya*

Birds were netted and ringed regularly in the communal roosts and breeding colonies of the study area. As far as possible the ringed birds were released at the points of capture.

Results

Feeding habits and behaviour

The Baya is resident in the cultivated parts and scrub-jungles of Rajampet throughout the year, breeding from mid April to mid November. From December to early April the birds are commonly met with in flocks numbering upto 200, feeding on freshly sown seeds and/or standing crops of paddy and millets from the milky stage on. During this period they feed in two distinct sessions from about 6-9 hrs. and 15-18 hrs. The hotter parts of the day are spent in shady mango orchards and betel-vine gardens. These day-roosts are important to the Bayas as bases for feeding operations and for co-ordinating the movements of flocks. From one such large midday roost (near Reddipalli) the Bayas were many times observed moving through the interiors of long thickets of Lantana and Ber growing between the cultivated fields. From such perching posts the birds dropped surreptitiously into the unguarded parts of the field, and unless detected fed for periods of upto 15 minutes. The return movements to the roosts after feeding were very stereotyped also, and almost the reverse of the pattern of moving to feed. Sticking to this pattern helped in coordinating the movements of the group, concealing their activities and in moving to safety in case of attacks by watchers. During the breeding season feeding flocks contained upto 40 individuals and feeding was done throughout the day.

While feeding in freshly sown or harvested fields with stubble standing, the Bayas moved in conspicuous waves. Two or three hundred birds formed broad closely-packed rows parallel to the bunds and covered sections of the fields hopping picking grains some flying back to perches and some leap-frogging to positions in front producing the effect of a wave. Ward (1965) has described a similar feeding movement in queleas as 'roller feeding'.

Grains of paddy, grasses and Italian millets were dehusked before swallowing. Bajra, jowar and ragi were split but bajra and ragi were also swallowed whole. The Bayas drank water from the canals and ditches.

Between January and February the harvesting of paddy was completed and ragi planted in the study area. Bayas fed at this time from the standing crops and/or stubble of paddy and roosted during the nights in sugar cane. In April ragi, jowar and korra were available as food. Canes were cut by late April and the Bayas roosted in scrub jungles and reeds. In May the breeding activity of the Bayas reached a peak, and paddy was their chief food. By late June harvesting of paddy was over and bajra planted. The birds continued breeding depending on grains found on threshing floors and in stubble fields, and those growing wild in swamps and on bunds. Bajra reached the milky stage by early July and was thereafter an important food item till October. By September sugar canes grew to heights of over 2 m and the birds roosted on them. The Bayas stopped breeding in November, when if the rains were good, paddy would be available in various stages; if not, the birds consumed large quantities of Panicaceae grass seeds. The farmers who had pumps cultivated paddy throughout the year, in isolated plots. The ground feeding doves, parakeets, munias, sparrows and weaver birds attacked these crops.

The contents of stomachs and crops

Table 1 lists the food of the adult Baya revealed in stomachs and crops. Paddy 65 per

cent (by dry weight) bajra and weed seeds of Panicaceae (12% each) were consistent items. Among the grass seeds, *Echinochloa crus-galli, E. colona, Panicum repens* and *Brachiaria ramosa* were items most frequently eaten. These were the seeds which were available for a greater part of the year in the area of study. The composition by dry weight of various items taken on a monthly basis. The sexes were not considered separately as the differences in contents were minor. During the breeding season the stomachs of female birds showed more animal items particularly bits of shells of mollusca. Animal items with rare exceptions form-

TABLE 1

VARIOUS TYPES OF FOOD IN 503 SAMPLES OF STOMACH CONTENTS OF ADULT BAYAS EXAMINED AT RAJAMPET FROM FEBRUARY 1968 TO MARCH 1969

Item	Frequency	Percentage
Sorghum sp.	2	Traces
Setaria italica	4	0.12
Pennisetum typhoideum	105	11.9
Eleusine coracana	15	0.45
Oryza sp.	303	65.2
Cyperaceae (weed) seeds		
Fimbristylis miliacea	10	0.6
Panicaceae (weed) seeds	192	11.6
Panicaceae seeds Break-up		
Digitaria marginata	1	
Brachiaria ramosa	35	
Paspalum scrobiculatum	13	
Paspalidium flavidum	7	
Echinochloa colona/crus-galli	36	
Panicum repens	38	
Other Panicaceae seeds	91	
Anisomeles indica	2	Traces
Animal parts	72	3.2
Break-up of animal parts		
Mollusca (shells)	31	
Orthoptera (Grasshopper)	1	
Coleoptera, Carabidae, Scarabaeidae	21	
Scolytidae	3	
Lepidoptera caterpillars	13	
Hymenoptera	3	
Arachnida: Spiders, Salticidae, Lycosidae	3	

dominance of cultivated grain in the food of the Baya was expected since the uncultivated areas of foraging, even though vast, had little growth of grass due to scanty rainfall. Table 2 gives the occurrence of certain types of food in the stomach contents of the Baya in different months and figure 1 represents the percentage

ed less than 5 per cent of the stomach contents. This may be due to the small size of the samples examined each month.

Among the cultivated grains jowar and Italian millet formed only minor parts in the Baya stomach contents, and hard-coated grains of jowar were never seen in the adult Baya. These

TABLE 2

SEASONAL CHANGES IN THE DIET OF THE BAYA AT RAJAMPET 1968-1969

	March 1968	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April 1969
Oryza (Paddy)	+	+	+	+	+	+		+	+	+	+	+	+	+
Pennisetum (Bajra)				+	+	+	+	+	+					
Elesuine (Ragi)	+	+											+	
Setaria (Korra)							+	+	+				+	
Sorghum (Jowar)							+					+		+
Paspalum scrobiculatum									+	+				
Paspalidium flavidum										+	+	+		
Echinochloa sp.		+	+		+				+	+	+	+	+	
Panicum repens	+	+	+				+	+	+	+	+	+	+	
Brachiaria ramosa	+	+							+	+				
Fimbristylis							+	+	+	+	+			
Coldenia procumbens							+				+	+	+	
Digitaria marginata	← Breeding season →						+							
Anisomeles indica														
Coleoptera											+	+		
Orthoptera						+	+	+	+	+	+	+		
Mollusca			+											
Arachnida			+	+	+	+	+	+	+					
Lepidoptera			+	+		+				+	+			
Camponotus					+				+	+	+			
							+				+	+	+	

+ = Eaten in that month

two millets were not extensively or regularly grown in the main area of collection. Jowar was taken in the milky stage whenever this crop was available.

Feeding experiments on captive birds

(a) Capacity of the Baya for seeds of paddy and grass. Ten adult birds with an average bodyweight of 21.2 g consumed during a ten-day trial from 21 to 30 April 1969, 3.1 g dry

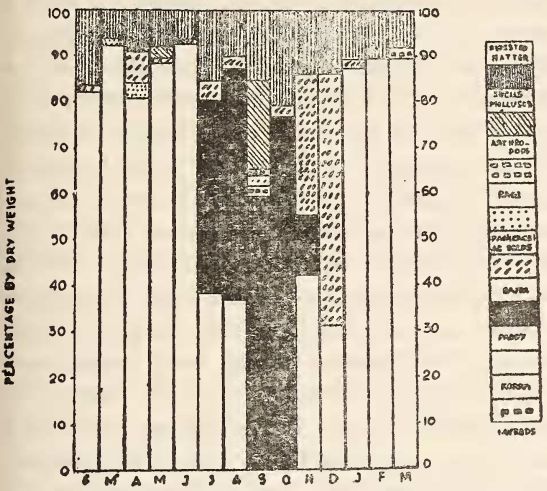


Fig. 1. Monthly changes in the stomach and crop contents of Bayas collected at Rajampet from February 1968 to March 1969.

paddy per bird per day or 0.15 g paddy per gram body weight per day. In a similar trial from 12 to 21 October 1970 with seeds of *Echinochloa colona* and *E. crus-galli* an adult bird with an average weight of 20.4 g consumed 3.4 g moisture-free seeds or 0.166 g per gram body weight per day.

(b) Preference of the Baya for different types of grains. From 7 to 16 July 1970, two sets of adult Bayas were offered equal quantities of paddy, bajra, korra and ragi. The birds preferred paddy 16.9 and 43.13 per cent and korra 46.92 and 69.3 per cent by weight. When the experiment was repeated with grains of *Echinochloa* spp. also added, the order of preference was: paddy 34.38 and 40.71 per cent (in two different sets); korra 35.96 and 36.3 per cent and *Echinochloa* spp. 14.45 and 23.25 per cent. These tests show that the Baya does not feed exclusively on paddy, but given the choice will consume seeds of Italian millet and *Echinochloa* as well. The Baya has a low preference for hard-coated seeds of bajra, and ragi. The quantity of water provided did not affect the uptake of grains by the captive birds.

Food of the nestling Baya

In the food given to the nestlings by the parents during four days, grasshoppers formed 33.3 per cent (by numbers), caterpillars 20 per cent, spiders 11.8 per cent, and grains 9.1

TABLE 3

FOOD OF THE NESTLING BAYA COLLECTED AT CUDDAPAH, PALGHAT AND MALAPPURAM DISTRICTS

Item	Percentage Wet weight
Oryza sp.	22.37
Pennisetum typhoideum	0.07
Sorghum sp.	1.16
Seeds of *Borreria, Coldenia, Lantana*	0.26
Mollusca (shells)	3.16
Spiders	0.30
Grasshoppers	34.89
Caterpillars	3.13
Pupae and other larval forms	1.05
Digested (unidentified plant and animal) matter	33.98
Animals identified from nestling stomachs	
Spiders: Lycosidae, Oxyopidae, Thomisidae, Argiopidae	
Grasshoppers: *Oxya velox, Epacromia dorsalis, Tryxalis turrita, Conocephalus* sp., *Chrotogonus* sp., *Acridium* sp.	
Crickets: *Trydactylus* sp. *Gryllus* sp.	
Cockroach: *Phyllodromia humbertiana*	
Termite: *Eutermes* sp.	
Caterpillars: *Boaris* sp., *Ismene* sp., *Papilio* sp.	
Flies: Maggots of *Eristalis* sp.	
Beetles: Tenebrionidae, Carabidae, Chrysomelidae	

per cent. About one third, by wet weight, of the stomach contents of the 53 nestlings dissected could not be identified. In these (Table 3) grasshoppers formed 34.9 per cent, grains of paddy 22.4 per cent, and caterpillars 3.1 per cent. The adult birds collected the food from the rice fields close to the nesting colonies.

Age and appearance of the Baya

1. *Nestling, male and female*

In the nestling the feathers of the upper parts are broadly edged rufous in place of the fulvous edges of the adult birds. The breast of the nestling is strongly tinged rufous and the bill is flesh coloured with the skin of the gape thick and yellow.

2. *Juvenile male and female*

In the newly fledged Baya (1-2 months old) the feathers of the upper- and underparts retain their strong rufous tinge. The very young juveniles have down sticking to the ends of their feathers. The skin of the gape is thick and yellow and the bill is flesh coloured. These two characters disappear by the time the juvenile is 2-3 months old so that the bird now has the same appearance as the adults in the off season. From November to almost the end of February the Baya population contains juveniles, first year birds, and adults in off-plumage, all having plumage and bills of more or less the same colour. Older juveniles of 3-6 months cannot be separated from the adults in off plumage.

3. *First-year males during the breeding season*

During the breeding season, the first-year males may or may not be in nuptial plumage. An 11-month old male (ringed as nestling) had a female type of plumage but a dark bill. A ringed male recaptured at the age of 15 months had donned complete nuptial plumage and had a dark bill.

4. *First year female during the breeding season*

The female Baya breeds in its first year and has the same appearance as the older females.

5. *Adult male in prenuptial, nuptial, and postnuptial plumages*

At the time of the prenuptial moult the male Bayas which change from brown to golden on the head and breast and fulvous to blackish-brown on the chin and throat, show a mixture of all the respective colours. Beginning at the base of the bill, golden yellow feathers replace the fulvous-edged brown feathers of the crown. The blackish brown feathers appear here and there on the throat, and golden feathers on the breast. The bill turns from yellowish horn to blackish brown. Adult males in full nuptial plumage are found between mid April and November. In this plumage the crown, nape, breast and sides of the neck are golden yellow, and the bill chin and throat blackish brown. The feathers of the back, rump, and wing-coverts are dark brown in the centre and edged with fulvous. The abdomen and flanks are fulvous and sometimes washed with yellow. The rump also has a few yellow feathers. At the close of the breeding season the crown appears very pale due to fading. Brown feathers replace golden ones of the crown, beginning at the base of the bill. The chin and throat show a mixture of blackish brown and fulvous, and the bill becomes yellowish horn. In the off-plumage the adult male has the same appearance as the adult female.

6. *Adult female*

In the breeding season as well as in the off-season the female has brown upperparts with feathers edged fulvous-white, and fulvous underparts. The bill is horny yellow. The breeding female develops a brood patch. In two exceptional cases breeding females showed a yellow wash on the feathers of the breast and head.

Adult Bayas moult their body feathers twice in a 12-months period before and after breeding, in the prenuptial and postnuptial moults. The flight feathers, namely the remiges and rectrices, are changed only once in a 12-month period, i.e. after the breeding activities are over.

Breeding ecology

During the breeding season in 1970, i.e. from April 14 to November 12, 347 nests were examined. Evidence from ringed birds showed that a female Baya breeds when it is 12 months old. In exceptional cases a male may be ready to breed when 12-15 months old. Clutch size varied from 2-5 eggs the most frequent being of three. There was evidence from ringed birds that an adult male Baya raised three broods or more during a breeding season. From indirect evidence it was inferred that a female Baya raised more than 2 broods in one season. The female alone incubated the eggs and brooded the young. The incubation period was 14 days and the nestling period between 13-19 days. The males helped the females in feeding the young in some cases. Losses of eggs and young were heavy during the rainy season. In 290 nests 54.1 per cent of the eggs hatched and 18.4 per cent produced flying young. The breeding rate per adult bird was estimated as 1.6 fledgling, and increase in biomass 7.95 kg (wet) Baya for about 282 ha. This was out of 4.66 kg eggs laid in the whole season. Human interference, heavy rains, and munias nesting in breeding colonies of the Baya were known to have destroyed eggs and nestlings.

An estimate of the harmful and useful activities

From June to October 1970, a maximum of 119 adult males and 88 females were counted in the 282 ha tract. Based on these figures some crude estimates of the economic effects of the activities of the Baya were made. According to figures obtained in the locality, the study area could produce 86,994 kg of dry paddy between July and October. From feeding experiments on captive adult Bayas, like those referred to earlier, it was found that a bird weighing an average of 22.5 g took 3.62 g of dry paddy per day. Assuming that all the 207 adult Bayas had stayed in the area and fed only on paddy produced there for 4 months from 1 July to 31 October at the above rate, the maximum possible damage by them would equal 94.8 kg which is 0.11 per cent of the paddy produced in this area during this time. By similar calculations based on feeding rates of captive birds and feeding behaviour observed in nature, it was estimated that a flock of 186 Bayas could have eaten 3.86 kg (dry) of panicaceae weed seeds from the study area in December 1968. It was found that during the last 3 or 4 days of nestling-life the weights of the nestling Bayas did not change much. If all the nestling Bayas which left nests in the 1970 breeding season in the study area were fed by their parents at observed rates they would have destroyed 9268 or 2.8 kg (wet) grasshoppers and 10771 caterpillars in the last three days of their nestling-life. When the abundance of the grasshoppers in the study area was also considered, the fraction destroyed by the Bayas alone was probably negligible. On the average 128 grasshoppers were counted in the paddy field of the study area in five minutes in 19 observations in 1970. These are only very rough estimates. At the present population density, the Bayas of the area could not be doing serious damage or significant service to standing crops.

Status and local movements

During the years 1968-1971, 460 nestling Bayas and 1085 older birds were ringed. These

birds were trapped in nets or taken from nests in some of the 30-40 breeding colonies, and also netted from the roosts in the four sugarcane fields of the study area. Thirteen ringed as nestlings and 60 of the older birds were retrapped. Nine of the former were recaptured within 1-8 months of nest leaving, from the roosts of adults in sugarcane. This showed that these roosts were important to the newly fledged Baya. Twenty-two first year and older birds originally netted and ringed at one roost were retrapped at the same roost between intervals of two weeks to two years after ringing. Netting at different roosts in the area showed that some of the Bayas changed roosts within a single season. Bayas ringed at one roost were recaptured at breeding colonies in five adjacent hamlets and villages at distances of 1-2 km from the roosts. There were also a few cases of the Bayas ringed in feeding grounds in the rice fields recaptured at the roost in sugarcane. Recaptures of the Bayas ringed at breeding colonies showed that the breeding Bayas did not move very far and probably bred in the same area, if not at the same colonies, year after year. Five Bayas ringed as nestlings in the breeding season 1970 were recaptured breeding in 1971 in colonies 10 m to 4.8 km distant from the colonies where they were raised. Thus the recaptures of ringed birds showed that the Baya was a resident in the study area, and moved about locally within a distance of 2-5 km from its breeding area. The practice of growing sugarcane near fields of paddy was very favourable to the Baya. These roosts provided protection at night, coordinated the movements of the newly fledged and adult birds, and probably helped the Bayas in locating good sources of food and breeding sites.

Discussion

The ecology and biology of the Baya were studied in detail in order to understand its economic status. Eventhough the Baya is popularly believed to be a pest of grain crops no systematic study of its feeding habits had been done in any particular area. Rajampet taluk proved to be ideal for such a study. The environmental conditions here were rigorous. Paddy, the main food of the Baya and ragi were grown throughout the year, and other grain crops like bajra, jowar and Italian millet at least once a year. The stomach contents of the Bayas collected in Rajampet over a period of a year showed paddy (65%), bajra and Panicaceae weed seeds (about 12% each) as the consistent items. In November and December when cultivated crops were few, Panicaceae weed seeds formed 38 and 52 per cent. Preference tests showed adult Bayas preferring seeds of paddy, Italian millets, and weed seeds *Echinochloa* spp. from a choice of 5 including bajra and ragi also. The predominance of paddy in the Baya's food could be due to the fact that paddy is the main crop of the study area. The fact that seeds of Italian millet and *Echinochloa* were also preferred points to the possibility that the smaller Panicaceae seeds were the traditional food of Plocid birds and that in areas where paddy is not so extensively grown the Baya consumes more of Panicaceae weed seeds. The low preference of seeds of ragi is significant. This may perhaps be a means of ecological adjustment with the ground feeding doves of the area which take ragi in large quantities. It is clear from this study that grasshoppers and caterpillars from a major part of the food given to nestlings by the adults.

Attacks on standing crops of paddy by the

Bayas were often based in the mango orchards situated near rice fields and concealed by the thickets of lantana, ber, and neem bordering fields. The Bayas exploit the local layout of crops very efficiently, particularly the combination of paddy and millets with sugarcane and betel vine grown nearby. The latter crops provide ideal roosts and places of assembly for the birds of all age-classes and very safe refuges for the fledglings, and the adults weakened by the rigours of a breeding season and heavy moult. When the sugarcanes were cut the movements of Bayas were disorganized and they were forced to roost in less safe places like scrub jungles and reeds.

Clearing of the bordering bushes and changing the layout of crops so as to eliminate the safe bases, mid-day and nightly roosts may prove effective measures of prevention in areas where the Baya is a pest.

Examination of ringed birds shows that it is possible to identify the different age-classes of the Baya in the field during the breeding season. This is the period when a meaningful census of the birds may be done. In the post breeding period the subadults, first year birds, older juveniles, and the adults of both sexes, all have the female type plumage. It is difficult to judge the age of the Baya at this time.

Very low nesting success inspite of a long breeding season is an economically important feature about the Baya's breeding biology. In collecting caterpillars and grasshoppers from paddy fields for its young the adult Baya does definite service to agriculture. High rates of loss of eggs and nestlings check the size of the Baya population. At the present population level of less than one adult bird per ha, the Baya may not do any serious damage to standing crops in the study area. Yet many farmers reported that the Bayas were causing large scale destruction of their crops. In every case study on the spot revealed that the area attacked was an isolated tract where paddy had matured much earlier than in the adjacent fields. Such plots attracted doves, parakeets, munias and sparrows and suffered much damage. By planting and harvesting in unison with general practice of the area, excessively large concentration of granivorous birds in small plots may be avoided. Cultivation of grain crops in the off season in isolated plots may be necessary to increase the production of food, but it is incorrect to blame any particular species of bird for the damage suffered by such plots. Only by careful observation in the field during different parts of the day can one determine which species of birds are actually involved.

Since the population size of the Baya in the study area was too low to do either serious damage or significant service to agriculture its economic status there should be described as neutral.

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